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IS 8394 (1977): Soldering and welding type terminal ends for conductors of insulated cables [ETD 9: Power Cables]

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(Including Amendment No. 1 & 2)
IS : 8394 - 1977
(Reaffirmed 2002)

Indian Standard

SPECIFICATION FOR SOLDERING AND WELDING TYPE TERMINAL ENDS FOR CONDUCTORS OF INSULATED CABLES

1. Scope — Specifies material and dimensional requirements of copper, brass and aluminium terminal ends (soldering and welding types) for copper and aluminium conductors of insulated cables for rated voltages up to and including 11kV.

2. Terminology

2.1 *Terminal End* — A connecting device with barrel accommodating respective conductor size of electrical cable and which has a fixing arrangement of termination by means of a bolt fixing or pin insertion in tunnel type terminal blocks and screwing.

2.2 *Open-Close Type Terminal End* — A stamped terminal end which is blanked out of a copper sheet in the form of an open-tube into which the cable is to be inserted before soldering (*see* Table 1).

2.3 *Tubular Type Terminal End* — A terminal end made out of copper tube, into which the cable can be soldered and which is of suitable shape externally for making connection between the cable and other parts of the circuit by means of a screw bolt or stud (*see* Tables 2 and 3).

2.4 *Hot-Pressed/Cast Type Terminal End* — A terminal end made out of brass by hot pressing or casting, into which, the cables can be soldered and which has suitable shape externally for making connection between the cable and the other parts of circuit by means of a bolt or stud (*see* Table 4).

2.5 *Reducer (Solid) Pin Type Terminal End* — A terminal end made out of solid brass rod by machining, into which the cable can be soldered and which has suitable shape externally for insertion in equipment like tunnel type block and can be tightened by means of a screw (*see* Table 5).

2.6 *Welding Type Terminal End* — A terminal end into which a cable can be inserted and welded by application of a welding torch and filling material and which is of suitable shape externally for making connection between the cable and other parts of the circuit by means of a bolt or stud (*see* Table 6).

3. Material

3.1 *Open-Close Type and Tubular Type* — Copper in the form of a sheet metal/tube having a resistivity not more than 2·16 $\mu\Omega$ cm^2/cm (80 percent IACS).

3.2 *Reducer (Solid) Pin Type* — Hot-pressed and cast brass of 70 : 30 grade according to IS : 319-1968 'Specification for free-cutting brass rods and sections (*second revision*)' and IS : 292-1961 'Specification for brass ingots and castings (*revised*)', respectively.

3.3 *Welding Type* — Cast aluminium or extruded aluminium rods having resistivity not more than 2·873 $\mu\Omega$ cm^2/cm (60 percent IACS).

4. Finish

4.1 Copper and brass terminal ends shall be coated with tin and the flux used for the purpose of tinning shall be non-corrosive. The average thickness of tin coating shall be not less than 10 μm and the coating shall be such as to ensure efficient soldering without further cleaning.

4.2 The faces of each side of the palm of all the varieties of terminal ends shall be parallel and flat to provide a suitable surface contact.

4.3 Welding type terminal ends shall have a smooth finish and be well formed on both sides of palm surface so as to form a proper contact with termination.

5. Dimensions — Dimensions of terminal ends shall be as given in Tables 1 to 6.

Note — Grub screw shall be supplied with the terminal end (*see* Tables 4, 5 and 6).

6. Marking — Terminal ends shall be marked with the designation given in Tables 1 to 6

Adopted 14 February 1977

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH [illegible]
NEW DELHI 110002

Conductors and Power Cables Sectional Committee, ETDC 32; Panel for Cable Accessories, ETDC 32 : P7 [Ref : Doc : ETDC 32(1543)]

6.1 *Certification Marking* — Details available with the Bureau of Indian Standards.

Note — Markings shall not be on the contact surface.

7. Recommended Sampling Plan — *See* Appendix A.

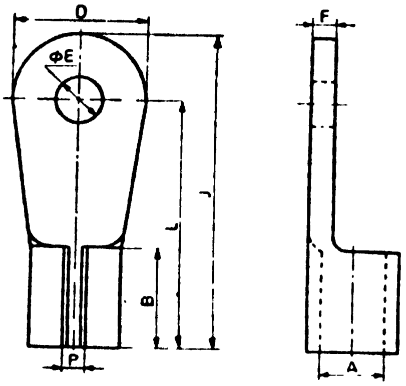
8. Tests

8.1 *Visual Examination and Dimensional Check-up* — Check for dimensions given in the relevant tables and also examine for freedom from flaws, rust, crevices, cracks and other defects harmful for the joints.

TABLE 1 SOLDERING TYPE COPPER OPEN-CLOSE TERMINAL ENDS FOR ALUMINIUM CONDUCTORS

(*Clauses* 2.2, 5 *and* 6)

All dimensions in millimetres.



Designation*	φE ±0·1	φE† Enlarged ±0·1	A	D ±0·2	F	B	L	J	P
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
SKA-1·5	3·2	4·2	2	6	0·75-0·85	5	11	14	1
SKA-2·5	3·2	4·2	2·5	6	0·75-0·85	6	13	16	1
SKA-4	3·2	4·2	3	7	0·94-1·06	6	14·5	18	1
SKA-6	3·2	5·2	4	8	0·94-1·06	7	18	22	2
SKA-10	4·2	6·4	5	10	0·94-1·06	9	21	26	2
SKA-16	5·2	8·2	6	12	1·19-1·31	11	24	30	2
SKA-25	6·4	10·2	7	14	1·53-1·67	14	28	35	2
SKA-35	6·4	10·2	8	16	1·53-1·67	15	32	40	2
SKA-50	6·4	10·2	10	18	1·70-1·90	18	38	47	2
SKA-70	8·2	12·7	12	22	1·9-2·1	23	44	55	3
SKA-95	10·2	12·7	14	26	2·4-2·6	25	50	63	3
SKA-120	10·2	16·2	16	28	2·75-2·93	29	56	70	4
SKA-150	10·2	16·2	17	32	3·02-3·28	30	60	76	4
SKA-185	10·2	16·2	19	36	3·42-3·68	35	66	84	4
SKA-225	12·7	16·2	21	40	3·42-3·68	40	70	90	5
SKA-240	12·7	20·3	23	44	3·87-4·13	42	76	98	5
SKA-300	16·2	20·3	25	48	4·37-4·63	45	83	107	5
SKA-400	16·2	20·3	30	54	4·84-5·16	54	94	121	7
SKA-500	20·3	—	32	58	5·24-5·52	58	106	135	7
SKA-630	20·3	—	36	70	5·24-5·52	65	113	148	8

General tolerances: ±5 percent, unless otherwise specified.

*First letter *S* stands for jointing method, *Soldering;* second letter *K* for open-close type terminal end; third letter for applicable conductor material, *Aluminium;* and the numerals separated by a hyphen from the third letter stand for nominal conductor size in mm².

†If purchaser desires to have a larger stud hole than the standard hole specified in col 2, stud hole size shall be chosen from 4·2, 5·2, 6·4, 8·2, 10·2, 12·7, 16·2 and 20·3 mm subject to a maximum given in col 3.

AMENDMENT NO. 2 OCTOBER 1987

TO

IS:8394-1977 SPECIFICATION FOR SOLDERING AND WELDING TYPE TERMINAL ENDS FOR CONDUCTORS OF INSULATED CABLES

(*Page* 1, *clause* 3.2) - Substitute the following for the existing clause:

"3.2 *Reducer (Solid) Pin Type* - Hot-pressed and cast brass of 70 : 30 grade according to IS:6912-1985 'Specification for copper and copper alloys forgings (*first revision*)' and IS:292-1983 'Specification for leaded brass ingots and castings (*second revision*)' respectively."

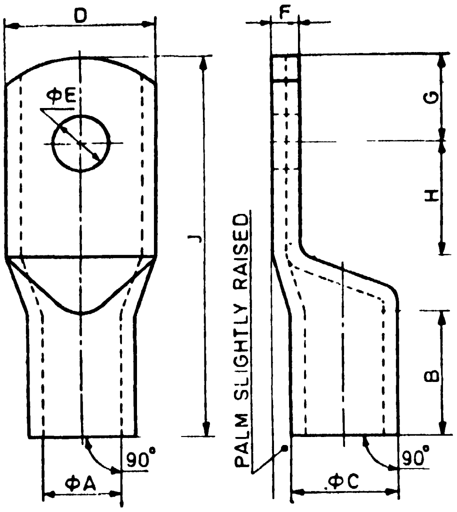
(ETDC 59)

Printed at Prabhat Offset Press, New Delhi-2

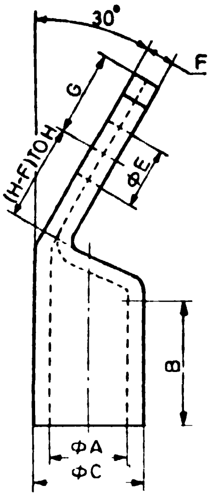
AMENDMENT NO. 1 MARCH 1980
TO
IS : 8394-1977 SPECIFICATION FOR SOLDERING AND WELDING TYPE TERMINAL ENDS FOR CONDUCTORS OF INSULATED CABLES

(*Page* 3, *Table* 2):

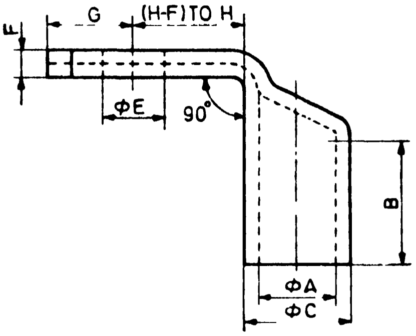
a) Substitute the following for the existing figures:



Type 1



Type 2



Type 3

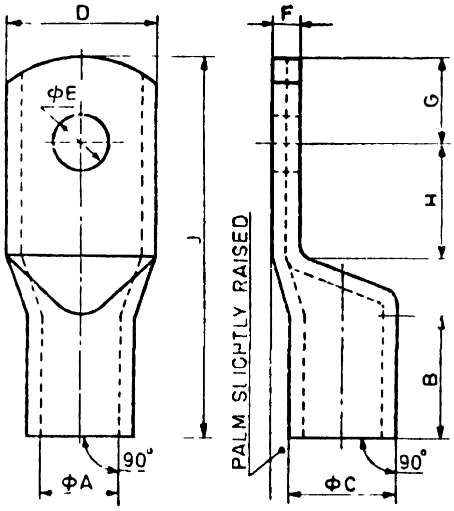
b) *Designation* SCC-400, *col* 5 — Substitute '40·9' *for* '40·8'.

c) Add the following new note under the table:

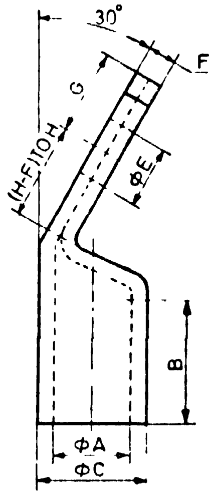
'**Note** — If the purchaser desires to have the inspection vent, its size and location may be as agreed between the manufacturer and the user.'

(*Page* 4, *Table* 3):

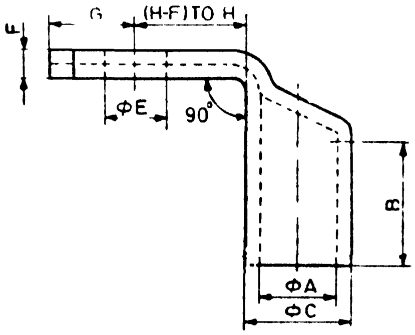
a) Substitute the following for the existing figures:



Type 1



Type 2



Type 3

b) *Designation* SCA-6, *col* 5 — Substitute '5·5' *for* '3·5'.

c) Add the following new note under the table:

'**Note** — If the purchaser desires to have the inspection vent, its size [illegible] the manufacturer and the user.'

(ETDC 59)

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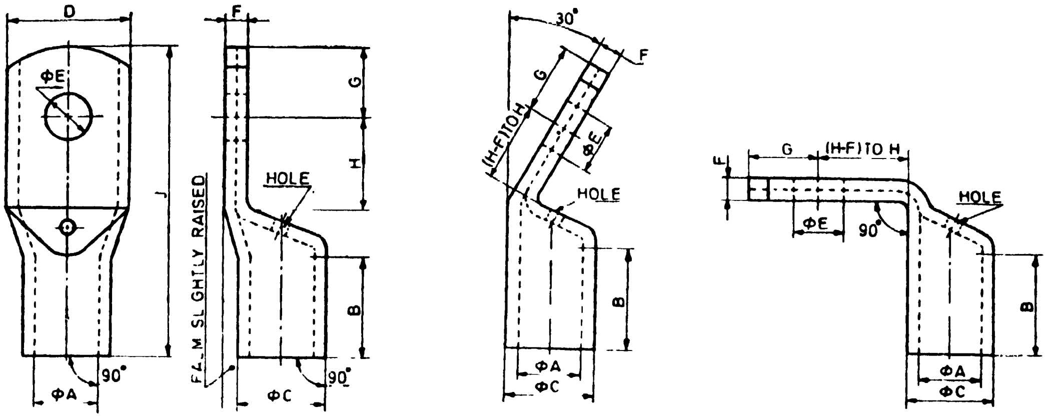
TABLE 2 SOLDERING TYPE COPPER TUBULAR TERMINAL ENDS FOR COPPER CONDUCTORS

(*Clauses* 2.3, 5 *and* 6)

All dimensions in millimetres.



TYPE 1 TYPE 2 TYPE 3

Designation*	*ϕE* ±0·1	*ϕE*† Enlarged ±0·1	*ϕA*‡	*ϕC*‡	*D*	*E*‡	*B*‡	*H*‡	*G*‡	*J*‡
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
SCC-10	4·2	5·2	4·8	6·2	8·6-9·2	1·4	10	7	5	25
SCC-16	5·2	8·2	6·4	8·2	11·5-12·1	1·8	13	10	6	33
SCC-25	6·4	10·2	8·0	10·8	15·0-15·8	2·8	13	12	10	39
SCC-35	8·2	10·2	9·5	13·1	18·1-18·9	3·6	14	14	10	46
SCC-50	10·2	12·7	12	16·6	23·0-23·8	4·6	19	17	12	56
SCC-70 SCC-95	10·2	12·7	14·3	19·5	27·3-28·1	5·2	22	18	12	62
SCC-120	12·7	16·2	16·7	22·5	31·5-32·5	5·8	29	23	17	80
SCC-150 SCC-185	16·2	20·3	20·6	27·8	39·1-40·1	7·2	32	28	20	93
SCC-225 SCC-240	16·2	20·3	23·8	31·0	44·1-45·1	7·2	38	30	22	104
SCC-300	20·3	—	26·2	34·2	49·6-50·8	8·0	44	33	25	118
SCC-400	20·3	—	31·7	40·8	58·4-59·6	9·2	48	40	30	136
SCC-500 SCC-630	20·3	—	36·5	46·1	66·3-67·7	9·6	56	44	34	154

*First letter *S* stands for jointing method, *Soldering;* second letter *C* for terminal end material, *Copper;* third letter *C* for applicable conductor material, *Copper;* and the numerals separated by a hyphen from the third letter stand for nominal conductor size in mm².

†If purchaser desires to have a larger stud hole than the standard hole specified in col 2, stud hole size shall be chosen from 6·4, 8·2, 10·2, 12·7, 16·2 and 20·3 mm subject to a maximum given in col 3.

‡*Tolerances on:*

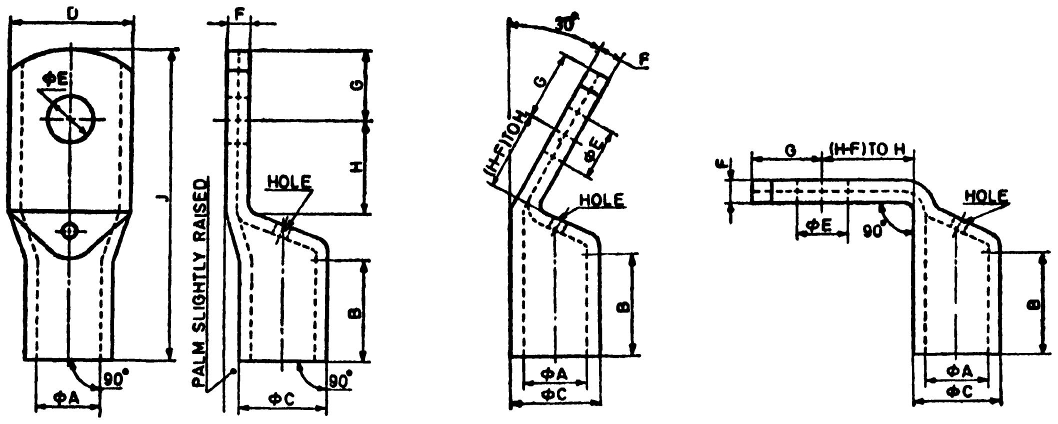
A and *C* : According to Table 3 of IS : 5493-1969 'Dimensions for wrought copper and copper alloy tubes'.
F : 2 × tolerances according to Table 2 of IS : 5493-1969.

B, H, G and *J* : ±5 percent.

TABLE 3 SOLDERING TYPE COPPER TUBULAR TERMINAL ENDS FOR ALUMINIUM CONDUCTORS

(*Clauses* 2.3, 5 *and* 6)

All dimensions in millimetres.



TYPE 1 TYPE 2 TYPE 3

Designa-tion* (1)	*ϕE* ±0 1 (2)	*ϕE*† Enlarged ±0 1 (3)	*ϕA*‡ (4)	*ϕC*‡ (5)	*D* (6)	*F*‡ (7)	*B*‡ (8)	*H*‡ (9)	*G*‡ (10)	*J*‡ (11)
SCA-2 5	3 2	3 7	2 9	4 7	6 0-6 6	1 8	7	6	6	22
SCA-4	3 2	4 2	3 5	5 5	7 2-7 8	2 0	9	6	6	24
SCA-6	3 2	5 2	3 8	3 5	7 4-8 0	1 7	9	6	6	24
SCa-10	4 2	5 2	4 4	6 2	8 4-9 0	1 8	9	6	6	24
SCA-10	4 2	6 4	5 4	7 2	10 0-10 6	1 8	12	8	6	30
SCA-16	5 2	8 2	7 0	9 0	12 7-13 3	2 0	12	12	8	37
SCA-25	6 4	10 2	8 0	10 0	14 3-14 9	2 0	12	12	8	37
SCA-35	6 4	10 2	9 3	11 3	16 2-17 0	2 0	16	12	9	45
SCA-50	6 4	10 2	11 6	13 8	20 0-20 8	2 2	18	15	13	56
SCA-70	8 2	12 7	12 9	15 6	22 6-23 4	2 7	20	15	13	58
SCA-95	10 2	12 7	15 0	18 0	26 2-27 0	3 0	22	16	14	62
SCA-120	10 2	16 2	16 5	19 6	28 5-29 5	3 1	26	18	15	70
SCA-150	10 2	16 2	18 5	22 0	32 0-33 0	3 5	28	21	21	83
SCA-185	10 2	16 2	21 0	25 0	36 5-37 5	4	32	24	24	95
SCA-225	12 7	16 2	22 0	26 0	38 1-39 1	4	34	24	24	97
SCA-240	12 7	20 3	25 0	29 4	43 2-44 2	4 4	36	25	25	103
SCA-300	16 2	20 3	29	34 4	50 4-51 6	5 4	44	27	27	116
SCA-400	16 2	20 3	31	37	54 1-55 3	6	48	27	27	120
SCA-500	20 3	—	36	42 5	62 4-63 8	6 5	53	33	31	137
SCA-630§	—	—	39	46 3	67 9-69 3	7 3	68	38	37	168
SCA-800§	—	—	43 5	53 8	77 7-79 7	10 3	90	45	45	210
SCA-1 000§	—	—	49 8	58 8	86 6-88 6	9 0	90	45	45	210

*First letter *S* stands for jointing method, *Soldering*, second letter *C* stands for terminal end material, *Copper;* third letter *A* stands for applicable conductor material, *Aluminium* (*a* for single strand conductor and *A* for multistrand conductor, where depending upon conductor construction, for a particular conductor size, two terminal ends are specified); and the numerals separated by a hyphen from the third letter stand for nominal conductor size in mm^2.

†If purchaser desires to have a larger stud hole than the standard hole specified in col 2, stud hole size shall be chosen from 3 7, 4 2, 5 2, 6 4, 8 2, 10 2, 12 7, 16 2 and 20 3 mm subject to a maximum given in col 3.

‡*Tolerances on:*

A and *C* : According to Table 3 of IS: 5493-1969.

F : 2×tolerances according to Table 2 of IS: 5493-1969.

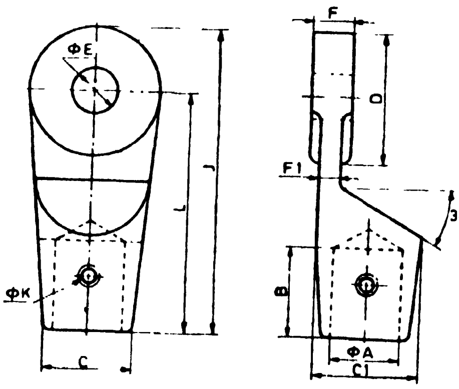
B, H, G and *J* : ±5 percent.

§These terminal ends are without stud holes (blank).

TABLE 4 SOLDERING TYPE BRASS HOT-PRESSED/CAST TERMINAL ENDS FOR ALUMINIUM CONDUCTORS

(*Clauses* 2.4, 5 *and* 6)

All dimensions in millimeters.



Designation*	ϕE $\pm 0{\cdot}1$	ϕE† Enlarged $\pm 0{\cdot}1$	ϕA	C	$C1$	D $^{+0}_{-1}$	F	$F1$	B	L	J	ϕK
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
SBA-25	6·4	8·2	8	11	13	14	5·0	3·3	13	31	38	M3
SBA-35	6·4	8·2	9	13	15	16	5·9	4·2	15	35	43	M3
SBA-50	6·4	10·2	10	13	15	18	5·9	4·2	15	35	44	M3
SBA-70	8·2	12·7	13	16	19	22	6·7	5·0	19	44	55	M3
SBA-95	10·2	12·7	14	18	22	26	7·5	5·8	23	49	62	M3·5
SBA-120	10·2	16·2	16	22	25	30	8·4	6·7	25	55	70	M4
SBA-150	10·2	16·2	18	27	32	32	10·0	8·3	30	65	81	M4·5
SBA-185	10·2	16·2	20	30	36	36	10·0	8·3	33	73	91	M5
SBA-225	12·7	16·2	22	30	36	40	10·0	8·3	33	73	93	M6
SBA-240	12·7	20·3	24	31	37	44	10·0	8·3	33	73	95	M6
SBA-300	16·2	20·3	26	34	40	48	11·7	10·0	38	83	107	M6
SBA-400	16·2	20·3	30	39	43	54	13·4	11·7	46	94	121	M8
SBA-500	20·3	—	33	39	43	58	13·4	11·7	46	94	123	M8
SBA-630	20·3	—	38	44	52	68	13·4	11·7	53	110	144	M10

General tolerances: ±5 percent, unless otherwise specified.

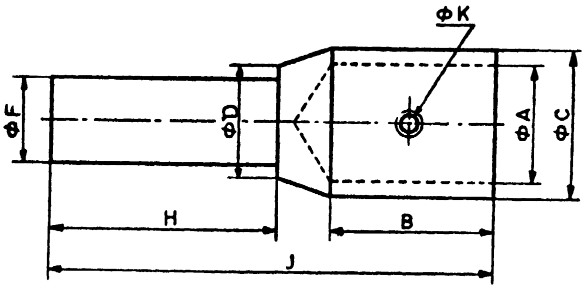
*First letter *S* stands for jointing method, *Soldering;* second letter *B* for terminal end material, *Brass*; third letter *A* for applicable conductor material *Aluminium;* and the numerals separated by a hyphen from the third letter stand for nominal conductor size in mm^2.

†If purchaser desires to have a larger stud hole than the standard hole specified in col 2, stud hole size shall be chosen from 8·2, 10·2, 12·7, 16·2 and 20·3 mm subject to a maximum given in col 3.

TABLE 5 SOLDERING TYPE BRASS REDUCER (SOLID) PIN TERMINAL ENDS FOR ALUMINIUM CONDUCTORS

(*Clauses* 2.5, 5 *and* 6)

All dimensions in millimetres.



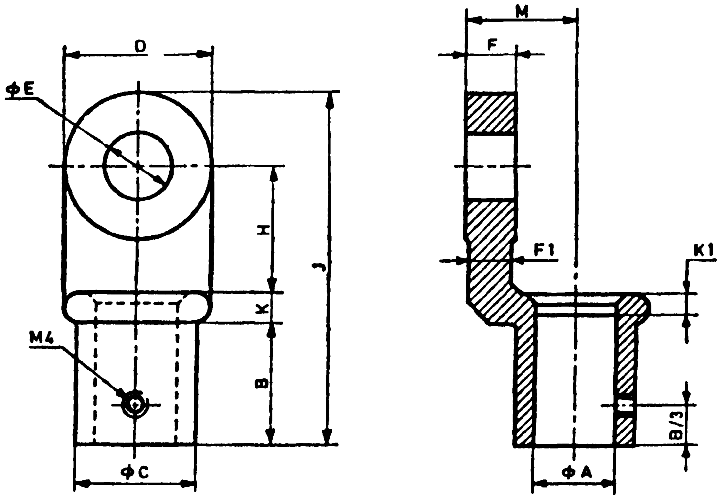
Designation*	ϕA	ϕC	ϕD	ϕF	B	H	J	ϕK
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SPA-10	5	7 9	4 5	4 0	9	13	27	—
SPA-16 SPA-25	8	11 1	6 4	5 5	14	17	37	—
SPA-35/1 SPA-50/1	11	14 3	9 0	6 4	15	22	43	M3
SPA-35/2 SPA-50/2	11	14 3	6 4	5 5	15	27	48	M3
SPA-70/1	13	15 9	9 5	7 0	19	22	47	M3
SPA-70/2	13	15 9	12 7	9 5	19	27	52	M3
SPA-95	15	19 0	14 2	11 0	22	34	62	M4
SPA-120	17	22 2	14 2	11 0	22	34	64	M4
SPA-150/1	18	22 2	15 8	7 0	25	22	55	M4 5
SPA-150/2	18	22 2	15 8	11 0	25	34	67	M4 5
SPA-150/3	18	22 2	16 7	13 5	25	34	67	M4 5
SPA-185	20	25 4	17 5	13 5	25	38	71	M5
SPA-225	22	28 6	17 5	15 9	28	38	74	M6
SPA-240	24	28 6	17 5	15 9	28	38	74	M6
SPA-300/1	26	31 8	22	11 0	28	22	58	M6
SPA-300/2	26	31 8	22	15 9	28	38	74	M6

General tolerances: ± 5 percent, unless otherwise specified.

*First letter *S* stands for jointing method, *Soldering;* second letter *P* for *Pin Type Brass Terminal End;* third letter *A* for applicable conductor material, *Aluminium;* and the numerals, separated by a hyphen from the third letter stand for nominal conductor size in mm^2 (numeral 1, 2 etc, appearing after an oblique line indicate more than one terminal end for a particular conductor size).

TABLE 6 WELDING TYPE ALUMINIUM TERMINAL ENDS FOR ALUMINIUM CONDUCTORS

(*Clauses* 2.6, 5 *and* 6)



Designation*	ϕE ±0·1	ϕE† Enlarged ±0·1	ϕA	ϕC	D +0 −1	F	F1	B	K	K1	H	J	M
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
WAA-25	6·4	8·2	8	15	14	6	5	16	4	2	18	45	14
WAA-35	6·4	8·2	9	15	16	7	6	18	5	3	17	48	15
WAA-50	6·4	10·2	10·5	17	18	7	6	21	5	3	21	56	16
WAA-70	8·2	12·7	12	20	22	8	7	24	6	3	22	63	18
WAA-95	10·2	12·7	14	23	26	9	8	24	7	4	25	69	21
WAA-120	10·2	16·2	16	25	30	10	9	26	7	4	27	75	23
WAA-150	10·2	16·2	18·5	27	32	11	10	28	7	5	30	81	25
WAA-185	10·2	16·2	20	30	36	12	11	30	7	5	31	86	27
WAA-225 WAA-240	12·7	20·3	24	31	44	12	11	36	9	6	31	98	29
WAA-300	16·2	20·3	26	36	48	12	11	38	9	6	30	101	30
WAA-400	16·2	20·3	31	42	52	12	11	40	10	7	30	106	34
WAA-500	20·3	—	33	45	58	14	13	42	12	8	41	124	36
WAA-630	20·3	—	37	49	58	14	13	47	12	9	41	129	39
WAA-800	—	—	41	54	64	15	14	52	12	10	46	142	42
WAA-1 000	—	—	46	60	76	15	14	52	15	10	51	156	47

General tolerances: ±5 percent, unless otherwise specified.

*First letter *W* stands for jointing method, *Welding*; second letter *A* for terminal end material, *Aluminium;* third letter *A* for applicable conductor material, *Aluminium;* and numerals separated by a hyphen from the third letter stand for nominal conductor size in mm².

†If purchaser desires to have a larger stud hole than the standard hole specified in col 2, stud hole size shall be [illegible] from 8·2, 10·2, 12·7, 16·2 and 20·3 mm subject to a maximum given in col 3.

APPENDIX A

(*Clause* 7)

RECOMMENDED SAMPLING PLAN FOR TERMINAL ENDS

A-1. Lot — In any consignment, the terminal ends of the same type manufactured by the same factory during the same period shall be grouped together to constitute a lot.

A-2. Scale of Sampling — From each lot a certain number of terminal ends shall be selected at random and subjected to tests (*see* **8**). Any terminal end failing to satisfy the appropriate requirement specified in the specification shall be considered as defective.

A-2.1 The number of terminal ends to be selected depend on col 1 and 2 of Table 7. The terminal ends shall be selected at random.

TABLE 7 SCALE OF SAMPLING

Lot Size N	First Stage n	Second Stage n	$2n$	C_1	C_2	C_3
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Up to 300	8	8	16	0	2	2
301 to 500	13	13	26	0	3	4
501 to 1 000	20	20	40	1	4	5
1 001 and above	32	32	64	2	5	7

A-2.1.1 In order to ensure randomness for selection, random number tables shall be used (*see* IS : 4905-1968 Methods for random sampling).

A-3. Number of Tests and Criteria for Acceptance — Each of the terminal ends selected in the first stage in accordance with col 2 of Table 7 shall be tested for visual examination, and dimensional check up (*see* **8.1**). If the number of defectives is less than or equal to C_1 the lot shall be considered as conforming to the requirements of the standard. If the number of defectives is equal to or greater than C_2, the lot shall be considered as not conforming to the requirements of the standard. If the number of defectives in the first stage is between C_1 and C_2, a further sample of same size as taken in the first stage shall be taken and tested. If the number of defectives in the two samples combined is less than C_3, the lot shall be considered as conforming to the requirements of the test, otherwise not.

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